Connectionism vs. Computational Theory of Mind

Angel Garrido
Faculty of Sciences, National University of Distance Education, Madrid, Spain
Paseo Senda del Rey, 9, 28040, Madrid, Spain
algbmv@telefonica.net

Abstract

Usually, the problems in Artificial Intelligence may be many times related to Philosophy of Mind, and perhaps because this reason may be in essence very disputable. So, for instance, the famous question: *Can a machine think?* It was proposed by Alan Turing. And it may be the more decisive question, but for many people it would be a nonsense. So, two of the very fundamental and more confronted positions usually considered according this line include the Connectionism and the Computational Theory of Mind. We analyze here its content, with their past disputes, and current situation.

Keywords: Knowledge Representation, Philosophy of Mind, Connectionism, Heuristics, Artificial Intelligence.

1. Introduction

The answer to the question about if will be considered a Machine, or a Computer, as a Mind, had produced a very copious scientific and philosophical literature. Initially, with the seminal paper of Alan Turing [16], by their *Turing Machine* idea and the long time debatable *Turing Test.* Also it must to be mentioned the attempt of refutation of John Searle [5-8], by the so-called *Chinese Room Argument.*

After the ideas expressed by Turing, some of the participants in the Darmouth Conference (1956) giving the trend known as *Strong A I*; represented by authors as, for instance, may be Marvin Minsky [3].

2. Turing Test

The very popular Turing´s Test departs from supposing that an interrogator is connected to one person and one machine, via a terminal, and therefore cannot see their counterparts. Its task is to find out which of the two contestant candidates will be the machine, and which will be the human, only by their answer to questions. If the interrogator cannot make a decision within a reasonable time, then the machine is considered to be intelligent. The initial Turing estimate as reasonable margin was five minutes, but the length of this interval is irrelevant.

We comment now some about the Turing ideas. In his paper [9], written in 1950, Turing proposed an operational definition of intelligence that was chosen to be equally applicable to humans and machines. The test was described as a generalization of a parlor game Turing called the imitation game. The basic idea of this game is that an interrogator attempts to determine the sex of one contestant by asking questions and receiving answers in writing. The goal of at least one contestant answering these questions is to cause an interrogator to make the wrong determination. No information is available to an interrogator other than the written answers, and at least one of the contestants answering questions is not obligated to tell the truth.

The Turing Test purpose, in its original form, is to replace by a machine one of the contestants of the imitation game who is not required to be truthful. If the results obtained from the game are unaffected by the presence of this machine, then this machine is said to be capable of thought. In other words, a machine that is indistinguishable from a human being solely on the basis of "written" interaction is considered to be capable of thought.

3. Connectionism

It was few more than mere speculations until the middle of the 20th century, but from the 1980´s [2], it become very popular among researchers. Initially, the “perceptron theory” was

formulated by F. Rosenblatt, in the 1950´s-1960´s, being unpopular from the book *Perceptrons,* by Minsky and Papert, where they showed that only some functions can be calculated by these models.

Connectionism can be defined saying that it hopes to explain human intellectual abilities using Artificial Neural Networks. It models behavioral or mental phenomena, as emergent processes of interconnected networks of simple units. The more usual are constructed by Neural Network models. The connection form can vary between different models. So, in the Brain modeling, units can represent neurons, whereas their connections will be the synapses.

4. Computational Theory of Mind

John Searle´s [5] argument, proposed in 1980, is intended to show that implementing a computational algorithm that is formally isomorphic to human thought processes cannot be sufficient to reproduce thought. Something more is required. So, it will be considered an attempt of refutation of both, Turing Test and Functionalism. Searle published his argument in an issue of Scientific American [6]. Thus, Searle affirms that Strong (but not Weak) AI is a clear nonsense.

We refer, obviously, on the well-known Chinese Room Argument, which was revised in our own precedent paper [1]. It is clearly related with the different arguments and lines of research considered here.

According the Computational Theory of Mind (CTM, in acronym), our mind is merely a digital computer. Not as a digital computer, but properly a form of such device. So, it will be a discrete-state device that store symbolic representations, manipulated by syntactic rules.

It will be an extension of the old idea according which "thought is mental representation", also called *"representationalism"*.

Formalization permits us to link semantics to syntax. And by computers, how to link syntax to causation.

5. Connectionism vs. CTM

Despite of the initial success of connectionists ideas, in the 1980´s, some researchers reacted against them. For example, Jerry Fodor and S. Pinker [4]. They argued that the Computational Theory of Mind was in serious risk to fall in Computationalism, seeing the mental activity as a merely computational process, i.e. only operating by formal operations on symbols. In this sense, it would be considered as a Turing Machine.

Computationalists generally forms on mental models and syntactic rules. Whereas Connectionists, on learning the information as connections between neurons.

Computationalists opinion is that internal mental activity consists of simple manipulation of explicit symbols. Whereas according to Connectionists, such manipulation will be a very poor model of mental activity.

More recently, the topic of Dynamical Systems is increasing in Philosophy of Mind. So, it wold be argued that the precedent debate is merely a split between Computationalism and Dynamical Systems Theory.

6. Conclusions

As in many other situations of life, the middle will be perhaps the best election. The underneath troubles will be perhaps because their ideological, ethical and religious implications, with some emergent "secondary effects".

But while Artificial Neural Networks provide us with a potential technological platform for thinking machines, the technology is too nascent as yet.

For these reasons, we have showed here some of the very bitter confrontation of Connectionists against Computational Mind theorists.

7. References

[1] Garrido, A: (2009). The Turing Test and the Chinese Room Argument. *EIJ-AMO (Advanced Modeling and Optimization journal)*, 11(4), 589-592, Bucharest: ICI Press, CAMO & New Yorl: CUNY.
[2] Haugeland, J. (Ed.) (1981). *Mind Design.* Cambridge, MA: MIT Press.
[3] Minsky, M., Papert, S. (1969). *Perceptrons.* Cambridge, MA: MIT Press.
[4] Pinker, S., Mehler, J. (1988). *Connections and Symbols.* Cambridge, MA: MIT Press..
[5] Searle, J. (1980). Minds, Brains, and Programs. *The Behavioral and Brain Sciences,* 3, 417-457.
[6] Searle, J. (1984). *Minds, Brains and Sciences.* Cambridge, MA: Harvard University Press.
[7] Searle, J.(1990). *Is the Brain's Mind a Computer Program?*. *Scientific American,* 262 (1), 26-31.
[8] Searle, J. (1983). *Intentionality: An Essay in the Philosophy of Mind.* Cambridge, MA: Cambridge University Press.
[9] Turing, A. (1950). Computing Machinery and Intelligence. *Mind,* 59(236), 433-60.